NOTES ON THE STATUS OF *CLARIAS NGAMENSIS* CASTELNAU 1861 *C. MELLANDI* BOULENGER 1905, *C. PRENTISSGRAYI* (FOWLER 1930) AND *C. LAMOTTEI* DAGET AND PLANQUETTE 1967 (PISCES, CLARIIDAE) WITH THE REHABILITATION OF *DINOTOPTEROIDES* FOWLER 1930 AS A SUBGENUS OF *CLARIAS*

by

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RESUME.– *Dinotopteroides* Fowler, 1930 a été établi comme un sous-genre de *Clarias* (Pisces, Clariidae), comprenant les espèces avec une petite nageoire adipeuse. Le sous-genre contient deux espèces valides : *Clarias ngamensis* Castelnau, 1861 (avec ses synonymes *C. mellandi* Boulenger, 1905 et *Dinotopteroides prentissgrayi* Fowler, 1930) et *C. lamottei* Daget & Planquette, 1967. Une comparaison entre ces espèces et les espèces des genres *Heterobranchus* et *Dinotopteroides*, possédant également une nageoire adipeuse, a été réalisée.

SUMMARY.– *Dinotopteroides* Fowler, 1930 has been rehabilitated as a subgenus of *Clarias* (Pisces, Clariidae), containing the species with a small adipose fin. In this subgenus, two species are recognised as valid : *Clarias ngamensis* Castelnau, 1861 (with *C. mellandi* Boulenger, 1905 and *Dinotopteroides prentissgrayi*, Fowler, 1930 as its junior synonyms) and *C. lamottei* Daget & Planquette, 1967.

Finally a comparison between the *Dinotopteroides* species and the species of the genera *Heterobranchus* and *Dinotopterus*, all showing an adipose fin, has been made.

INTRODUCTION

In 1861 Castelnau described *Clarias ngamensis* from lake Ngami, South West Africa. As his description was very similar to those of *Clarias gariepinus* (Burchell, 1822), *C. lazera* Cuvier and Valenciennes, 1840 and *C. mossambicus* Peters, 1852 and as *C. lazera* was known as a widely distributed species, Boulenger (1908) synonymised *C. ngamensis* with it.

In 1905 Boulenger described *Clarias mellandi* from a single specimen from Lake Bangwelu The shape and the size of the vomerine toothplate (3 times as long as the premaxillary toothplate) are diagnostic characters for this species.

In 1911 Boulenger resurrected *Clarias ngamensis* on the basis of a specimen from Lake Ngami, which agrees with Castelnau's description, except for the

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shorter nasal barbel, smooth head and difference in coloration. However, according to Boulenger (1911) the specimen resembles *C. mellandi* and could be refered to it but for the shape of the vomerine toothplate. As this character varies with age, it might be suggested that both species are synonymous, were it not that the type of *C. mellandi* is smaller than that of *C. ngamensis,* and yet shows a longer vomerine toothplate than the latter. Therefore, Boulenger (1911) considered both as valid species.

In 1930 Fowler described *Dinotopteroides prentissgrayi,* a new genus and species of Clariid fish from the Quanza river in Angola. This genus was characterised by the presence of a small adipose fin. Fowler (1930) included the genus in the Heterobranchinae, with *Heterobranchus* Geoffroy Saint-Hilaire, 1809 and *Dinotopterus* Boulenger, 1906. In common with *Heterobranchus* it has the sides of the head furnished with bony shields, although it differs in having a shorter adipose fin. From *Dinotopterus* it differs in the different head structure and in possessing fewer gill rakers, 26 versus 110, on the lower limb of the first branchial arch.

Poll (1933), when comparing *Clarias mellandi* with *Dinotopteroides prentissgrayi,* noted their similarity. He also drew attention to a small adipose fin in the former, a character overlooked by Boulenger. Nevertheless, Poll (1933) considered the genus *Dinotopteroides* to be a junior synonym of the genus *Clarias,* stating that species with a small adipose fin emphasized the relationship between *Heterobranchus* and *Clarias.*

Although Fowler (1935) disagreed with Poll's opinion, David (1935) agreed. Presupposing a relationship with other long-headed *Clarias* species, David (1935) placed *C. ngamensis, C. mellandi* and *Dinotopteroides prentissgrayi* (erroneously spelled *Dinopteroides pentissgrayi*) in the subgenus *Clarias (Heterobranchoides),* which, due to nomenclatorial priorities, David and Poll (1937) had to change to *Clarias (Clarias).*

Greenwood (1961), in his study on the synonymy of the genera *Dinotopterus* Boulenger, 1906 and *Bathyclarias* Jackson, 1959, considered the three species as a group within the genus *Clarias* with poorly or scarcely developed adipose fin. The fin, however, can be clearly seen in radiographs or alizarin stained skeletons, where the elongated neural spines indicate its presence.

In 1967 Daget and Planquette described *Clarias lamottei* from four specimens from the Nzi river in Ivory Coast. This species possesses a small adipose fin and, according to the authors, has therefore to be considered as related to *C. ngamensis, C. mellandi* and *C. prentissgrayi.* Also the describers enclose Poll's statement (1933) that *Dinotopteroides* is a junior synonym of *Clarias.*

In the course of a systematic revision of the African species of the genus *Clarias,* the former classification (David, 1935) has been questioned by the inclusion of *C. ngamensis, C. mellandi, C, prentissgrayi* and *C. lamottei* in the subgenus *Clarias (Clarias)* together with *C. gariepinus* (of which *C. lazera* and *C. mossambicus* are junior synonyms, see Teugels, in press) and *C. anguillaris,* both lacking an adipose fin.

Moreover, the validity of some species has been questioned and a possible synonymy between *Clarias ngamensis* and *C. mellandi* has been suggested (Bowmaker, 1968 ; De Kimpe, 1964 ; Jubb and Gaigher, 1971). Furthermore, the relationship between *C. mellandi* and *C. prentissgrayi* has to be assessed, especially as Boulenger (1911a) reported *C. mellandi* from Angola.

All available material representing these species in various museum collections has been studied, using both external morphological and osteological characters.

MATERIAL

This study is based on the following 48 specimens, housed in the Koninklijk Museum voor Midden-Afrika (KMMA), Tervuren, Belgium, in the British Museum (Natural History) (BMNH), London, England, in the Muséum national d'Histoire naturelle (MNHN), Paris, France and in the Academy of Natural Sciences of Philadephia (ANSP), United States of America. The specific determinations are those given on the museum labels.

Clarias ngamensis Castelnau 1861

Neotype (BMNH 1910-5-31:27) 243 mm TL ; Lake Ngami, S.W. Africa ; coll. Woosnam.

1 specimen (KMMA 39551) 143 mm Total Length ; Kapanga, Katanga ; coll. Overlaet ; 1933.– 2 specimens (KMMA 161886-887) 88 - 94 mm TL ; Giraul lagoon, 25 km N.E. of Mossamedes. Angola ; coll. Dundo Museum ; 25-10-1949.– 2 specimens (BMNH 1910-5-27 : 19-20) 116 - 128 mm TL ; Umsitu river, Broken Hill, N.W. Rhodesia ; coll. Rogers and Chubb. – 1 specimen (BMNH 1965-3-15 : 198) Cubango river, Vila da Ponte, Angola ; coll. Bell-Cross. – 2 specimens (BMNH 1965-3-15 : 508-509) 441 mm TL ; Cunhangamua river at Cuina, Angola ; coll. Bell-Cross.– 1 specimen (BMNH 1976-3-18 : 2436) Thalamakane river, Upstream of Maun, Botswana ; coll. Banister and Connelly.

Clarias mellandi Boulenger 1905

Holotype (BMNH 1905-11-10 : 7) 339 mm TL ; Lake Bangwelu ; coll. Melland.

1 specimen (KMMA 33610) 509 mm TL : Lukonzolwa. Lake Moero : coll. de Witte ; 9/17-2-1931.– 1 specimen (KMMA 33613) 395 mm TL ; Kasenga ; coll. de Witte ; 2/6-3-1931. – 1 specimen (KMMA 33614) 357 mm TL ; Kasenga ; coll. de Witte ; 2/6-3-1931.– 1 specimen (KMMA 34160) 156 mm TL ; Kilwa, Lake Moero ; coll. de Witte ; 27-2-1931.– 2 specimens (KMMA 34161-162) 168 mm TL ; Kilwa, Lake Moero ; coll. de Witte ; 27-2-1931.– 1 specimen (KMMA 47430) 168 mm TL ; near Tshabunda ; coll. Gerard ; 1936.– 2 specimens (KMMA 83280-281) 390 mm TL ; Mukilapembe, Luapula river ; coll. Miss. Pisc. Katanga ; 16-2-1947.– 1 specimen (KMMA 83282) 367 mm TL ; Madingusha, Jadotville territorium. Lukoshi : coll. Miss. Pisc. Katanga ; 24-4-1947.– 1 specimen (KMMA 83283) 490 mm TL ; Mubingwishi river ; coll. Miss. Pisc. Katanga ; 7-5-1947. – 1 specimen (KMMA 83376) 163 mm TL ; Kibola, Luantishi river ; coll. Miss. Pisc. Katanga ; 15-4-1947. – 1 specimen (KMMA 83377) 156 mm TL ; Lufira river, Sampwe territorium ; coll. Miss. Pisc. Katanga ; 5/11-5-1947.– 1 specimen (KMMA 123711) 139 mm TL ; Kiubo, Lufira river ; coll. Hulot ; 16-4-1947.– 1 specimen (KMMA 183262) 406 mm TL ; Kipopo river, station ; coll. Thys van den Audenaerde ; 18-3-1960.– 2 specimens (BMNH 1907-6-29 : 206-207) 88 - 148 mm TL ; Dongwenna swamps, Mossamedes, Angola ; coll. Ansorge.– 8 specimens (BMNH 1932-12-15 : 593-600) 299 - 314 mm TL ; Lake Nyasa ; coll. Christy.– 1 specimen (BMNH 1932-12-16 : 234) 145 mm TL ; Luambwa river, N. Rhodesia ; coll. Pitnam.– 2 specimens (BMNH 1945-7-27 : 386-387) 329 mm TL ; Bangwelu swamps ; coll. Ricardo and Owen.– 3 specimens (BMNH

1960-3-7 : 1-3) 422 mm TL ; Lute, Fort Johnston, Nyasaland ; coll. Trewavas ; 1-3-1939.– 1 specimen (BMNH 1969-9-25 : 36) Chiansi lagoon, Kafue, Zambia ; coll. Carey and Trewavas ; 1965.

Dinotopteroides prentissgrayi Fowler 1930

Paratype (ANSP 51799) 267 mm TL ; Chouzo, Quanza river, Angola ; coll. Prentiss N. Gray ; 1929.

Clarias lamottei Daget and Planquette 1967

Holotype (MNHN 66-1104) 149 mm TL ; Aoué Bla, tributary of the Nzi river, Bandama basin, near Lamto, Ivory Coast ; coll. Planquette ; 28-5-1966.

3 paratypes (MNHN 66-1105) 122-164 mm TL ; Aoué Bla, tributary of the Nzi river, Bandama basin, near Lamto, Ivory Coast ; coll. Planquette, 28-5-1966.

The distribution of the above specimens is shown in figure 1.

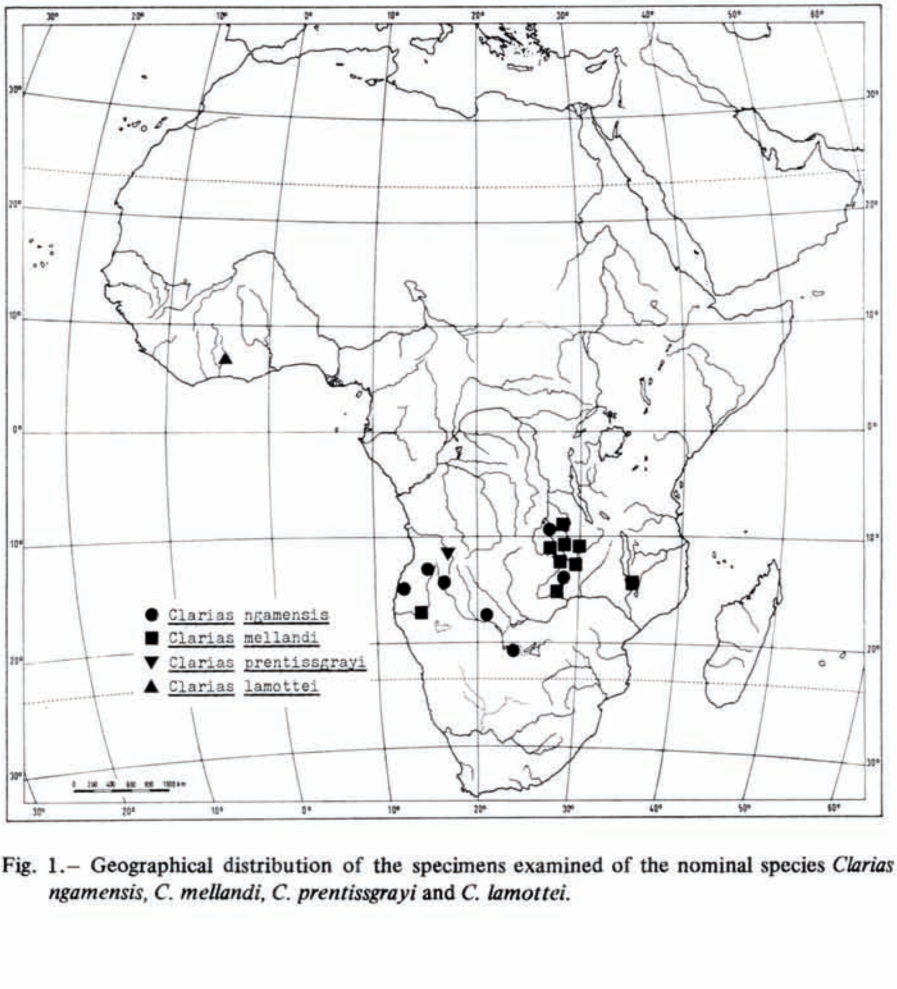

Fig. 1.– Geographical distribution of the specimens examined of the nominal species *Clarias ngamensis*, *C. mellandi*, *C. prentissgrayi* and *C. lamottei*.

METHOD

Ignoring previous determinations, all specimens except for the types, were divided in the following geographical groups :

- the Malawi (Nyasa) group
- the Kafue group
- the Bangweulu group
- the Luapula-Moero group
- the Upper Zaire group
- the Central Zaire group
- the Angola group

These different groups were analysed using external morphological and meristic data. Definitions of the measurements used are given elsewhere (Teugels, in press) ; in addition to those parameters, it will be noted that in the descriptions below, the distance between the dorsal and the caudal fins is the length of the adipose fin. Some characters display negative allometry (eye diameter, length of the barbels, length and width of the fontanels) : therefore no mean values were calculated. The data are given in tables I and II.

The type specimens of the nominal species recorded from the areas covered by the above named groups, were subject to the same character analysis. These data are given in tables III and IV. Although the holotype of *Clarias ngamensis* was lost in a fire (Whitley, 1965), Castelnau's description (1861) and Boulenger's

Table I : Body proportions and meristic counts for the Luapula-Moero/Upper Zaire and Angola groups.

	Luapula-Moero group			Upper Zaire group			Angola group		
	m̄	(min.- max.)	n	m̄	(min.- max.)	n	m̄	(min.- max.)	n
Total length(mm)		(156.0-509.0)	8		(139.0-367.0)	5		(86.0-441.0)	5
Stand.length(mm)		(138.0-435.0)	8		(120.0-312.0)	5		(74.0-384.0)	5
Head length(%StL)	31.6	(31.0- 32.3)	8	32.0	(31.3- 32.6)	5	31.6	(30.9- 32.3)	5
Head width(%StL)	18.2	(18.1- 18.5)	3	18.8	(17.9- 19.6)	5	18.9	(16.8- 19.9)	4
Head depth(%StL)	10.5	(10.0- 11.0)	4	11.2	(10.4- 11.8)	5	12.7	(12.3- 13.0)	2
Snout length(%HL)	21.0	(19.6- 22.2)	3	21.3	(21.1- 21.5)	3	20.0	(19.1- 20.9)	4
Interorb.width(%HL)	37.2	(37.2- 39.3)	7	38.1	(37.0- 39.5)	5	37.3	(35.1- 39.2)	4
Eye diameter(%HL)	-	(6.6- 8.8)	2	-	(7.9- 9.4)	2	-	(8.9- 10.6)	3
Length nas.barb.(%HL)	-	(50.6- 69.5)	5	-	(50.4- 79.2)	5	-	(63.0- 64.3)	2
Length max.barb.(%HL)	-	(75.2-109.7)	6	-	(77.1-105.5)	4	-	(78.7- 95.7)	3
Length inn.md.barb.(%HL)	-	(46.9- 61.4)	4	-	(49.1- 67.8)	4	-	(57.4)	1
Length out.md.barb.(%HL)	-	(68.1- 79.2)	4	-	(71.4- 94.8)	5	-	(76.2-100.9)	4
Length front.font.(%HL)	-	(24.8- 32.8)	6	-	(28.5- 32.8)	4	-	(28.5- 34.2)	4
Width front.font.(%HL)	-	(7.2- 8.8)	4	-	(6.4- 9.4)	4	-	(8.2- 11.9)	4
Length occ.font.(%HL)	-	(6.2- 12.3)	6	-	(8.1- 14.8)	5	-	(12.1- 18.4)	4
Width occ. font.(%HL)	-	(2.9- 6.1)	5	-	(5.1- 6.2)	5	-	(6.0- 7.7)	4
Width occ.proc.(%HL)	-	(19.5)	1	-	(-)	-	-	(19.6)	1
Length occ.proc.(%HL)	-	(16.3- 16.9)	2	-	(16.0- 19.5)	3	-	(18.3- 22.6)	3
Width premax.(%HL)	21.4	(20.7- 22.7)	6	23.0	(22.3- 23.7)	5	23.5	(22.6- 24.3)	4
Length premax.(%HL)	4.5	(3.6- 5.3)	6	4.8	(4.3- 6.0)	5	5.2	(5.2)	1
Width vomer.(%HL)	20.7	(19.1- 21.8)	6	21.9	(20.6- 22.5)	5	21.4	(19.2- 23.2)	4
Length vomer.(%HL)	10.7	(8.8- 12.4)	4	10.2	(9.2- 10.9)	5	10.6	(10.6)	1
Predors.dist.(%StL)	36.3	(34.4- 37.2)	4	37.3	(36.2- 37.8)	5	35.5	(35.3- 35.8)	4
Preanal dist.(%StL)	56.2	(54.6- 60.5)	4	54.9	(52.9- 56.7)	5	54.6	(52.6- 55.8)	4
Prepelv.dist.(%StL)	47.7	(46.1- 51.5)	4	46.9	(45.5- 47.9)	5	47.8	(46.8- 49.1)	4
Prepect.dist.(%StL)	24.0	(22.2- 25.5)	4	24.3	(23.4- 25.0)	5	24.1	(22.9- 25.1)	4
Length dors.fin (%StL)	58.8	(55.2- 61.6)	4	54.6	(53.2- 55.4)	5	54.5	(53.9- 55.6)	4
Length anal fin(%StL)	42.4	(41.9- 44.0)	4	42.8	(40.7- 44.9)	5	44.0	(41.5- 46.0)	4
Length pelv.fin(%StL)	9.7	(9.1- 10.6)	4	9.4	(8.5- 10.2)	5	9.5	(9.2- 9.7)	4
Length pect.fin(%StL)	14.0	(13.0- 14.6)	3	13.6	(12.0- 14.6)	4	13.3	(12.7- 14.5)	4
Length pect.spine(%StL)	9.4	(8.6- 10.6)	3	8.9	(7.9- 9.6)	4	8.0	(7.6- 8.4)	4
Dist.dors.-caud.(%StL)	8.2	(5.9- 9.6)	8	10.2	(8.3- 12.5)	5	9.8	(8.2- 11.2)	5
Dist.occ.pr.-dors.(%StL)	5.0	(2.2- 7.0)	7	5.6	(5.0- 6.4)	5	4.0	(3.1- 4.7)	4
Caud.ped.depth(%StL)	9.7	(9.7)	2	9.0	(8.8- 9.2)	2	9.9	(9.3- 10.4)	2
Body depth anus(% StL)	15.5	(15.1- 16.0)	4	15.8	(14.4- 17.8)	4	15.8	(14.9- 16.6)	2
Gill rakers on 1st arch		24-31	5		23-32	5		18-23	4
Dorsal fin rays		56-60	3		57	1		60-63	4
Anal fin rays		50-53	3		54	1		52-58	4
Branchiostegal rays		8-9	2		-	-		10	1
Vertebrae		56-57	3		57	4		59-60	3

Table II : Body proportions and meristic counts for the Malawi-Kafue-Bangwelu and Central Zaire groups.

	MALAWI group			KAFUE group			BANGWEULU group			CENTR. ZAIRE	
	m̄	(min.- max.)	n	m̄	(min.- max.)	n	m̄	(min.- max.)	n	m̄	n
Total length(mm)		(299.0-422.0)	3		(116.0-128.0)	2		(144.4-329.0)	2	143.0	1
Stand.length(mm)		(263.0-359.0)	3		(99.3-110.6)	2		(125.3-284.0)	2	121.0	1
Head length(%StL)	30.5	(29.3- 31.6)	3	30.0	(29.5- 30.5)	2	33.0	(32.3- 33.6)	2	32.9	1
Head width (%StL)	18.7		1	16.1	(15.8- 16.3)	2	18.4	(18.0- 18.7)	2	19.5	1
Head depth(%StL)	10.0		1	10.8		1	10.5	(9.7- 11.2)	2	11.1	1
Snout length(%HL)	-		-	21.7		1	17.2		1	24.4	1
Interorb.width(%HL)	37.4		1	35.9		1	35.5	(34.4- 36.5)	2	38.9	1
Eye diameter(%HL)	6.9		1	9.5		1	6.8		1	8.3	1
Length nas.barb.(%HL)	48.0		1	66.8		1	59.0		1	58.8	1
Length max.barb.(%HL)	70.6		1	-	(88.1- 95.5)	2		(54.8- 83.5)	2	89.7	1
Lengthinn.md.barb.(%HL)	49.2		1	-		-	-	(41.6- 58.3)	2	63.8	1
Length out.md.barb.(%HL)	68.0		1	86.1		1	-	(51.6- 69.6)	2	80.4	1
Length front.font.(%HL)	33.6		1	-	(33.1- 36.5)	2	-	(29.9- 35.1)	2	28.9	1
Width front.font.(%HL)	7.7		1	-	(9.2- 15.0)	2	-	(7.5- 8.6)	2	6.8	1
Length occ.font.(%HL)	11.2		1	12.8		1	-	(6.2- 12.3)	2	11.6	1
Width occ.font.(%HL)	4.9		1	6.2		1	-	(4.1- 5.2)	2	6.0	1
Width occ.proc.(%HL)	21.9		1	19.9		1	-	(19.4- 20.2)	2	20.1	1
Length occ.proc.(%HL)	15.7		1	17.5		1	17.0		1	18.8	1
Width premax.(%HL)	22.4		1	23.5	(23.1- 23.9)	2	21.5	(20.4- 22.5)	2	23.4	1
Length premax.(%HL)	4.5		1	4.8	(4.5- 5.1)	2	4.9	(4.7- 5.1)	2	4.3	1
Width vomer.(%HL)	22.4		1	21.5	(21.1- 21.8)	2	20.4	(20.0- 20.7)	2	21.9	1
Length vomer.(%HL)	10.9		1	6.2	(5.9- 6.5)	2	11.9		1	9.8	1
Predors.dist.(%StL)	34.2		1	35.2		1	37.9	(37.8- 38.0)	2	38.1	1
Preanal dist.(%StL)	53.6		1	53.7		1	57.2	(56.4- 58.0)	2	55.5	1
Prepelv.dist.(%StL)	45.9		1	44.6		1	48.3	(47.9- 48.6)	2	47.4	1
Prepect.dist.(%StL)	22.6		1	22.9		1	25.0	(24.7- 25.3)	2	24.6	1
Length dors.fin(%StL)	55.7	(54.3- 57.1)	2	56.0	(55.2- 56.7)	2	52.7	(51.8- 53.5)	2	59.0	1
Length anal fin(%StL)	42.0		1	43.7	(42.0- 45.4)	2	42.3	(41.8- 42.7)	2	44.9	1
Length pelv.fin(%StL)	8.7		1	-		-	9.3	(8.8- 9.8)	2	8.8	1
Length pect.fin(%StL)	12.4		1	13.1	(12.6- 13.5)	2	13.0	(12.8- 13.1)	2	14.5	1
Length pect.spine(%StL)	8.6		1	8.6	(7.9- 9.2)	2	9.0	(7.7- 10.2)	2	8.1	1
Dist.dors.-caud.(%StL)	9.2	(8.9- 9.6)	2	10.5	(10.4- 10.5)	2	9.1	(8.5- 9.7)	2	9.1	1
Dist.occ.pr.-dors.(%StL)	4.7		1	5.2		1	5.1	(4.8- 5.3)	2	6.0	1
Caud.pedun.depth(%StL)	-		-	8.2	(8.0- 8.4)	2	8.6		1	8.8	1
Body depth anus(%StL)	-		-	13.4	(12.8- 14.0)	2	15.4		1	15.0	1
Gill rakers on 1st arch		26	2		19 - 21	2		22 - 27	2	23	1
Dorsal fin rays		-	-		-	-		56 - 59	2	62	1
Anal fin rays		-	-		-	-		51 - 52	2	54	1
Pectoral fin rays		-	-		-	-		-	-	-	-
Branchiostegal rays		-	-		-	-		9	1	-	-
Vertebrae		-	-		-	-		-	-	57	1

redescription (1911) are clear enough to identify this species. Therefore, the specimen used by Boulenger (1911) for his redescription, registered BMNH 1910-5-31 : 27, originating form Lake Ngami, is designated as the neotype for *Clarias ngamensis*.

The two sets of data (geographical groups and types) were then subject to comparative analysis.

RESULTS

The presence of a small adipose fin in all specimens examined, can be discerned externally as a thickening of the caudal peduncle or by a distinct gap between the dorsal and the caudal fin (cf. figure 2).

All specimens examined have conical premaxillary teeth and granular vomerine

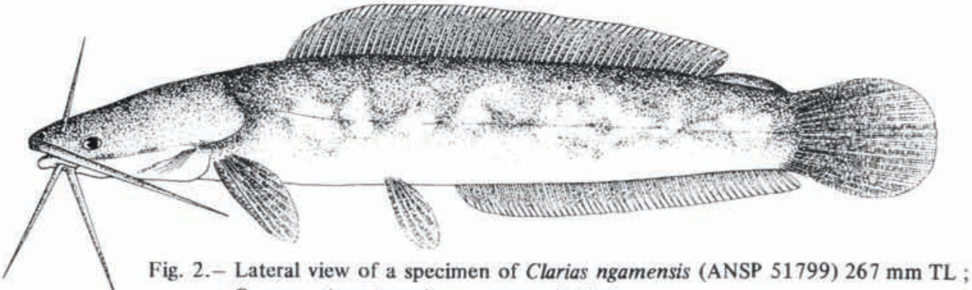

Fig. 2.– Lateral view of a specimen of *Clarias ngamensis* (ANSP 51799) 267 mm TL ; Quanza river, Angola ; paratype of *Clarias prentissgrayi.*

Table III : Body proportions and meristic counts for the neotype of *C. ngamensis*, the holotype of *C. mellandi* and the paratype of *C. prentissgrayi.*

	C.ngamensis neotype	C. mellandi holotype	C.prentiss-grayi paratype
Total length (in mm)	243.0	339.0	267.0
Standard length (StL in mm)	208.5	293.0	227.0
Head length (HL in % StL)	32.4	31.8	31.4
Head width (% StL)	17.5	18.4	18.6
Head depth (% StL)	9.9	12.2	11.0
Snout length (% HL)	22.0	21.4	21.6
Interorb. width (%HL)	37.0	35.2	37.0
Eye diameter (% HL)	7.1	6.9	7.4
Length nasal barbel (% HL)	49.6	39.8	42.8
Length max. barbel (% HL)	74.3	63.9	68.6
Length inn. mand. barbel (% HL)	48.4	44.0	46.3
Length out. mand. barbel (% HL)	62.9	55.1	63.3
Length frontal fontanel (% HL)	28.3	30.0	29.7
Width frontal fontanel (% HL)	7.2	6.3	8.7
Length occipital fontanel (% HL)	10.9	7.0	10.1
Width occipital fontanel (% HL)	6.1	3.8	6.0
Width occipital process (% HL)	-	18.8	17.3
Length occipital process (% HL)	-	14.6	19.2
Width premax. toothplate (% HL)	23.8	20.9	23.0
Length premax. toothplate (% HL)	5.0	4.9	4.1
Width vomerine toothplate (% HL)	21.7	18.5	19.8
Length vomerine toothplate (% HL)	8.3	14.4	8.3
Predorsal distance (% StL)	37.6	37.3	34.8
Preanal distance (% StL)	57.5	56.3	55.6
Prepelvic distance (% StL)	48.8	49.0	47.3
Prepectoral distance (% StL)	24.7	25.4	24.7
Length dorsal fin (% StL)	54.2	56.4	54.8
Length anal fin (% StL)	42.2	42.3	43.8
Length pelvic fin (% StL)	10.0	9.2	9.9
Length pectoral fin (% StL)	13.5	11.8	13.4
Length pectoral spine (% StL)	9.3	8.4	10.1
Dist. dorsal to caudal fin (% StL)	9.1	8.9	11.5
Dist. occ. process to dorsal fin (% StL)	5.0	5.4	3.5
Caudal peduncle depth (% StL)	-	10.3	9.5
Body depth at anus (% StL)	15.9	17.6	16.7
Gill-rakers on first arch	31	26	29
Dorsal fin rays	58	57	60
Anal fin rays	54	52	57
Pectoral fin rays	-	I.10	I.9
Branchiostegal rays	-	9	10
Vertebrae	-	-	60

teeth. In the various geographical groups, the vomerine toothplate is very long, 3-4 times longer than the premaxillary toothplate. This is the same as in the types of *Clarias mellandi* and *Clarias prentissgrayi.* In the types of *Clarias lamottei*, however, the vomerine toothplate is shorter than that of the premaxillary.

In all specimens the pectoral spine is serrated only along its outer side.

All specimens possess a well-developed suprabranchial organ, comparable to that found in *Clarias gariepinus* and *C. anguillaris.*

Most specimens examined exhibit pigmentation bars on both sides of the lower surface of the head, which also occur in *Clarias gariepinus* and *C. anguillaris* (Teugels, in press). Many specimens have a marbled body coloration (fig. 2). The disappearance of the marbled pattern in preserved specimens may be caused by delayed fixation after capture (Thys van den Audenaerde and Franck, personal communications).

The surface texture of the cranium varies with age : small specimens have a smooth skull whereas in large fishes it is rugose.

The lateral line is visible in most specimens often with the sensory openings clearly marked. In all specimens examined the openings form regular vertical branches of the lateral line.

Table IV : **Body proportions and meristic counts for the holotype and the paratypes of *C. lamottei*.**

	Holotype	Paratypes		
		$\bar{m}$	(min. -max.)	n
Total length (in mm)	149.0		(122.0-164.0)	3
Standard length (StL in mm)	128.0		(104.0-141.0)	3
Head length (HL in % StL)	30.0	30.3	(29.5- 30.9)	3
Head width (% StL)	18.4	18.1	(17.4- 18.3)	3
Head depth (% StL)	10.1	9.4	(9.0- 10.1)	3
Snout length (% HL)	20.3	22.2	(20.7- 24.4)	3
Interorb. width (% HL)	40.0	40.8	(39.7- 42.2)	3
Eye diameter (% HL)	-	-	(8.4)	3
Length nasal barbel (% HL)	59.0	-	(61.1- 74.4)	2
Length max. barbel (% HL)	-	-	(105.8-130.6)	3
Length inn. mand. barbel (% HL)	-	-	(55.7)	1
Length out. mand. barbel (% HL)	87.5	-	(86.3- 91.1)	2
Length frontal fontanel (% HL)	-	-	(30.0- 33.8)	2
Width frontal fontanel (% HL)	-	-	(7.8- 9.6)	2
Length occipital fontanel (% HL)	16.4	-	(15.3- 17.5)	3
Width occipital fontanel (% HL)	6.5	-	(6.3- 8.4)	3
Width occipital process (% HL)	-	-	(19.7)	1
Length occipital process (% HL)	19.2	-	(19.2)	1
Width premax. toothplate (% HL)	27.5	27.2	(26.6- 27.6)	3
Length premax. toothplate (% HL)	4.9	5.0	(4.9- 5.0)	2
Width vomerine toothplate (% HL)	22.3	23.5	(23.4- 23.6)	2
Length vomerine toothplate (% HL)	3.9	3.7	(3.6- 3.7)	2
Predorsal distance (% StL)	36.7	37.2	(37.0- 37.7)	3
Preanal distance (% StL)	59.0	58.7	(58.4- 58.9)	2
Prepelvic distance (% StL)	49.3	48.6	(48.3- 48.9)	2
Prepectoral distance (% StL)	22.3	22.6	(22.0- 23.2)	2
Length dorsal fin (% StL)	52.1	49.0	(48.3- 49.6)	2
Length anal fin (% StL)	41.2	40.3	(38.9- 41.6)	2
Length pelvic fin (% StL)	11.0	10.6	(10.6)	1
Length pectoral fin (% StL)	15.2	15.1	(14.9- 15.3)	2
Length pectoral spine (% StL)	7.8	8.1	(7.1- 9.0)	2
Dist. dorsal to caudal fin (% StL)	12.7	14.7	(13.3- 15.9)	3
Dist. occ. process to dorsal fin (% StL)	6.6	6.9	(6.5- 7.2)	2
Caudal peduncle depth (% StL)	8.2	8.3	(8.3)	1
Body depth at anus (% StL)	14.5	14.6	(14.1- 15.0)	2
Gill rakers on first arch	23	22 - 22 - 24		3
Dorsal fin rays	58	58 - 55 - 53		3
Anal fin rays	50	52 - 51 - 51		3
Pectoral fin rays	-	I.10 - - -I.10		2
Branchiostegal rays	10	10 - 9 - 10		3
Vertebrae	56	56 - 56 - 56		3

An osteological study, based on X-rays and alizarin stained skeletons, showed the same bone configuration of the skull for the different geographical groups as well as for the type specimens. An identical configuration is found in specimens of *Clarias gariepinus* and *C. anguillaris*. The skull is always completely ossified. Only in small specimens (< 120 mm TL) are the "dermosphenotic" bone and the supraorbital bone seen as separate elements.

In all specimens examined, elongated neural spines are found in the caudal peduncle region (figure 3b).

The caudal skeleton is identical in all specimens comprises a parhypural, five hypural bones, a preural bone (= urostype) and an epural bone. The same configuration is found in all other *Clarias* species.

DISCUSSION

Clarias ngamensis, *C. mellandi* and *C. prentissgrayi*

The information provided by the geographical groups shows that the Malawi group, the Bangweulu group, the Luapula-Moero group, the Upper Zaire group, the

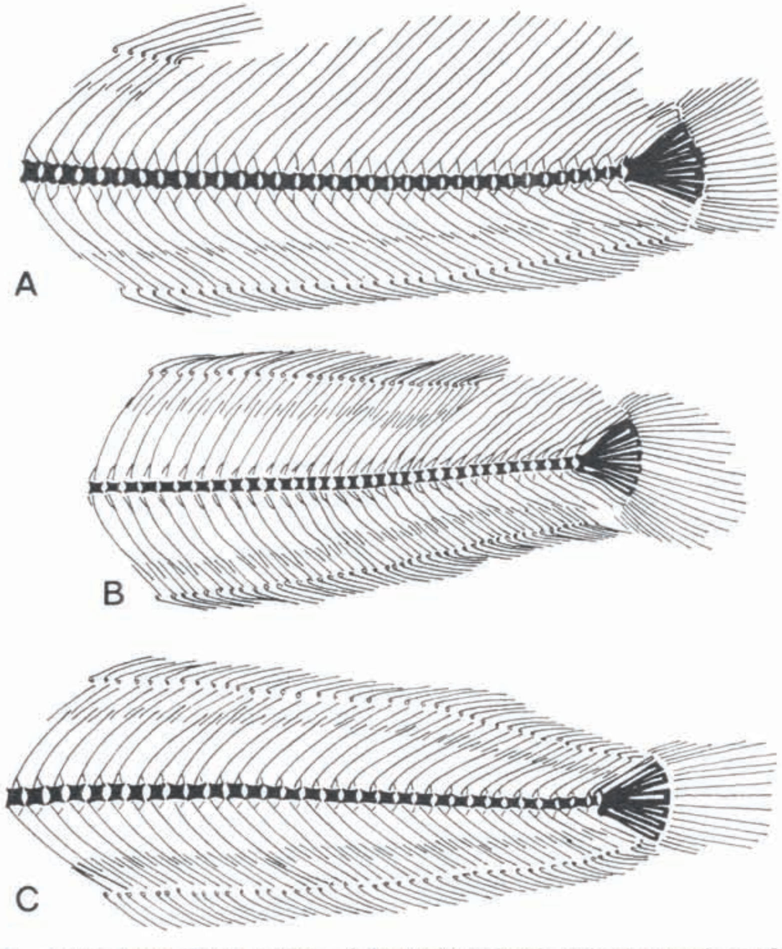

Fig. 3.– A lateral view of the skeleton of the caudal peduncle region in a specimen of *Heterobranchus longifilis* (KMMA 155070) 260 mm StL ; Khartoum, Soudan.
B. Lateral view of the skeleton of the caudal peduncle region in a specimen of *Clarias ngamensis*. (ANSP 51799) 227 mm StL ; Quanza river, Angola.
C. Lateral view of the skeleton of the caudal peduncle region in a specimen of *Clarias gariepinus* (ZMB 6591) 265 mm StL ; Tette, Mozambique. (Syntype of *C. mossambicus)*.

Central Zaire group and the Angola group are conspecific. The Kafue group differs only in having a smaller vomerine toothplate. This group, however, is represented by the two smallest specimens examined ; therefore, we consider it as conspecific with the other groups mentioned.

Comparison of the types of *Clarias ngamensis*, *C. mellandi* and *C. prentissgrayi* reveals a single difference, namely the length of the vomerine toothplate. Here also, the differences in body length have to be considered :

C. ngamensis	243 mm TL	8.3 % HL vomerine length
C. mellandi	339 mm TL	14.4 % HL vomerine length
C. prentissgrayi	267 mm TL	8.3 % HL vomerine length

Moreover, in the Luapula-Moero group is a specimen with a vomerine length of 8.8 % HL ; this is much closer to the proportions of the type of *C. prentissgrayi,* described from Angola, than to those for the type of *C. mellandi,* described from the Bangweulu Lake, which is connected with the Luapula-Moero system.

Our results demonstrate that the systematic value of the vomerine toothpatch length is restricted. Furthermore it seems to be an ecophenotypic character influenced by diet. Jackson (1961) and Bowmaker (1968) found that specimens identified as *C. mellandi,* originating from Lake Bangweulu and from Lake Malawi, contained mainly molluscs in their stomachs. To effectively crush these molluscs, a large vomerine toothplate is necessary. Willoughby and Tweddle (1978), however, found only 4 % of molluscs in the diet of *C. ngamensis* from the Shire Valley in Malawi. Chironomid larvae and dragonfly nymphs were the most important items in their diet. Also Willoughby and Tweddle (1978) found a very long vomerine toothplate, which they considered as an adaptation to the diet containing a high proportion of hard-shelled invertebrates. Both authors refer to Jackson's observations on *C. mellandi,* which they consider a junior synonym of *C. ngamensis.*

Comparing the data of the different geographical groups to those for the various types, no character can be found to distinguish specific groups. Therefore I must conclude that they all represent the same species. Thus *Clarias ngamensis, C. mellandi* and *C. prentissgrayi* have to be considered as conspecific. Priority dictates that the name *C. ngamensis* Castelnau 1861 will be used in future.

Clarias lamottei

In the original description of *Clarias lamottei,* Daget and Planquette (1967) indicated several differences between this species and *C. prentissgrayi.* I found only the length of the vomerine toothplate as different which is in *C. lamottei* always smaller than the premaxillary toothplate. All the other characters listed by Daget and Planquette (1967) are allometrically variable and are therefore different from those in *C. prentissgrayi.*

Apart from the original description, *Clarias lamottei* has only been reported once in literature, namely by Lévêque, de Mérona and Paugy (1977) who recorded the species from the Nzi river in the Ivory Coast, but preserved no specimens. In a personal communication Lévêque and Paugy confirmed their observations.

Because of the great similarity of *Clarias lamottei* to *C. ngamensis (= C. mellandi, = C. prentissgrayi),* the validity of this species is questioned. Until more material becomes available however, we continue to consider *C. lamottei* as a separate taxon.

The systematic status of *Clarias ngamensis* and *C. lamottei*

Comparing *Clarias ngamensis* and *C. lamottei* with the other species of the subgenus *Clarias (Clarias),* namely *C. gariepinus* and *C. anguillaris,* the presence of the small adipose fin in the former two species and its absence in the latter (figure 3 b & c), is considered an important character. Although the adipose fin is some-times hardly visible, its presence can always be verified by the elongated neural spines. Futhermore, there is always a gap between the end of the dorsal fin and the caudal fin base (about 10 % StL) in those species with an adipose fin, whereas in those lacking the adipose fin, this distance is reduced to about 5 % StL at maximum. In other characters, both groups are identical.

A comparison has been made between *Clarias ngamensis*, *C. lamottei* and the species of the genus *Heterobranchus*. This genus (a revision of which will be the subject of further study) can be divided into several groups. The group containing the nominal species *Heterobranchus bidorsalis* Geoffroy Saint Hilaire 1827, *H. longifilis* Cuvier and Valenciennes 1840 and *H. isopterus* Bleeker 1863 appear to be most closely related to *C. ngamensis* and *C. lamottei*, although differing in the much longer adipose fin (22.6 to 29.4 % StL versus ± 10 % StL), the broader interorbital distance (45.2 to 52.4 % HL versus 34.4 to 42.2 % HL), the shorter anal fin (37.4 to 38.7 % StL versus 38.9 to 46.0 % StL) and the broader toothplates. In all *Heterobranchus* species, the adipose fin is supported by elongated neural spines (figure 3a).

Comparison of *Clarias ngamensis* and *C. lamottei* with the species of the genus *Dinotopterus*, especially with *D. cunningtoni* Boulenger 1906, *D. nyasensis* (Worthington 1933) and *D. worthingtoni* (Jackson 1959) showed the following differences : *Dinotopterus* species have incomplete ossification of the cranium, as the lateral roofing bones of the skull are not formed into a continuous casque ; the eyes of *Dinotopterus* species are laterally placed, forming part of the head outline when viewed from above ; *Dinotopterus* species have a broader interorbital distance, a shorter anal fin and broader toothplates ; the number of gill rakers on the whole first arch ranges from 53 up to 260 (Jackson, 1959 ; Greenwood, 1961 ; personnal observations) versus 18 to 32 in *C. ngamensis* ; also there is great variability in the development of the suprabranchial organ in *Dinotopterus*. All *Dinotopterus* specimens examined showed elongated neural spines in the adipose fin.

A comparison between the species of the genera *Heterobranchus* and *Dinotopterus* listed above, show major differences in the incomplete ossification of the cranium in the latter, the laterally placed eyes in *Dinotopterus* species, the extremely high gill raker number on the whole first arch in *Dinotopterus* and the variability in the development of the suprabranchial organ. The adipose fin in *Heterobranchus* species is about three times as long as it is in *Dinotopterus* species. In other characters, such as the interorbital distance, the anal fin length and the toothplate width, *Heterobranchus* species seem to be closer related to *Dinotopterus* species than to *Clarias* species.

Although *Clarias ngamensis* and *C. mellandi* are closely related, the area gap between their respective geographic distributions makes it appear that they do not belong to a single phyletic entity. However, the fact that geographical distribution is of little significance comes from a comparison of *Denticeps clupeioides* Clausen and *Palaeodenticeps tanganikae* Greenwood. The former is restricted to a few streams in Nigeria and the latter, a fossil taxon, is known from a single locality to the South West of Lake Victoria. Reconsidering the material of both species, Greenwood (personnal communication) is now of the opinion that they have to be placed in a single genus, although no representatives of that genus have been found between Nigeria and Lake Victoria : the geographical gap is of less significance than the peculiar morphological characters shared by both species (Greenwood, in press).

De Vos and Thys van den Audenaerde (personal communication) point out the disjunct distribution between the two Schilbeid species of the genus *Irvinea* ; *I. voltae* Trewavas is known from the Volta river while *I. orientalis* Trewavas is reported from the Uebi Scebeli (Somalia).

In some of the more older African fish taxa (such as the clupeoids and the siluroids) their former distribution was probably continuous. Fragmentation of that distribution, speciation events amongst the isolated populations and the extinction of some taxa can probably explain the present distribution of some groups. In this light, there is no argument against considering *Clarias ngamensis* and *C. lamottei* as representatives of a single phyletic lineage.

The possession of an adipose fin is probably a primitive character for euteleosts (Rosen, 1973). Thus, within the Clariidae, the condition in *Heterobranchus* would be considered as the primitive one whereas those taxa with a continuous dorsal fin (i.e. loss of adipose fin) would be considered as derived (e.g. *Clarias*).

The adipose fin in *Heterobranchus*, along with that in *Dinotopterus*, *Clarias ngamensis* and *C. lamottei* is however modified from the primitive condition of being a mere ridge or membrane of skin. In these taxa, the fin is supported by extended neural spines. Such a feature is unknown in other siluroids and so must be considered an apomorph or derived character. Thus, on this character alone, *Heterobranchus, Dinotopterus, Clarias ngamensis* and *C. lamottei* would be closely related. *Heterobranchus, Clarias ngamensis* and *C. lamottei* have a virtually identical cranial osteology, but owing to the lack of comparative osteological data from other clariids it is not possible to decide whether this resemblance is due to shared primitive or derived similarities.

In view of the fact that information from other character complexes is lacking, it seems advisable to retain *Clarias ngamensis* and *C. lamottei* within the genus *Clarias*, but because of the obvious difference in neural spine-adipose fin morphology, they are hereby assigned to a separate subgenus *Clarias (Dinotopteroides)* Fowler 1930. The type species of this subgenus is *Dinotopteroides prentissgrayi* Fowler 1930, a junior synonym of *Clarias ngamensis* Castelnau 1861.

CONCLUSION

Four nominal species, *Clarias ngamensis, C. mellandi, C. prentissgrayi* and *C. lamottei*, all possessing a small adipose fin, have been studied using meristic and anatomical features. *Clarias mellandi* and *C. prentissgrayi* are shown to be synonymous with *C. ngamensis*.

Because of the development of the posterior neural spines, entering the small adipose fin, *Clarias ngamensis* and *C. lamottei* can be easily recognised from the other species of the subgenus *C. (Clarias)*. Therefore another subgenus, *Clarias (Dinotopteroides)* Fowler 1930, has been recognised to contain the *Clarias* species with a small adipose fin.

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